STEMI and PCI in Switzerland 2000-2010. Pre-hospital delay and door-to-balloon time

Radovanovic, D ; Urban, P ; Pedrazzini, G ; Rickli, H ; Erne, P

Abstract: Current guidelines for reperfusion therapy in patients with acute ST-elevation myocardial infarction (STEMI) undergoing percutaneous coronary intervention (PCI) recommend a door-to-balloon time of less than 90 minutes, even for patients transferred from hospitals without heart catheter laboratory facilities.

Originally published at:
Radovanovic, D; Urban, P; Pedrazzini, G; Rickli, H; Erne, P (2011). STEMI and PCI in Switzerland 2000-2010. Pre-hospital delay and door-to-balloon time. Leading Opinions. Kardiologie Gefässmedizin, (4):10-12.

STEMI and PCI in Switzerland 2000–2010

Pre-hospital delay and door-to-balloon time

Current guidelines for reperfusion therapy in patients with acute ST-elevation myocardial infarction (STEMI) undergoing percutaneous coronary intervention (PCI) recommend a door-to-balloon time of less than 90 minutes, even for patients transferred from hospitals without heart catheter laboratory facilities.[1–2]

To assess the situation in Switzerland between 2000 and 2010, we used data from the national registry of Acute Myocardial Infarction – AMIS Plus. Details of the AMIS Plus Registry have been published elsewhere.[3] All STEMI patients who underwent PCI were included.

Data were analyzed on pre-hospital delay, defined as the time between symptom onset and admission, and door-to-balloon time, defined as the time between admission and the first automatic arterial blood pressure measurement in the heart catheter laboratory.

From 2000 to 2010 a total of 10.408 STEMI patients from 66 Swiss hospitals underwent PCI. Of these patients, 77% were male and 23% were female.

Baseline characteristics of the STEMI patients changed slightly over the course of this 11-year time span (Tab.).

However, these changes were neither linear nor constant per admission year. A significant trend was seen in women with STEMI who were older at admission whereas the age of male patients remained the same. No changes were seen in patients with diabetes but there were significant increases in the amount of patients with hypertension and/or obesity. Fewer patients smoked, fewer patients had dyslipidemia and fewer patients had moderate to severe co-morbidities.

Delay between symptom onset and admission decreased significantly during this period of 11 years from 180 min (IQR 105, 482 min) to 170 min (100, 392 min). The greatest decrease was observed in 2008 after the national public campaign HELP of the Swiss Heart Foundation.[4]

Baseline characteristics of STEMI patients

	All patients	Admission year 2000	~	Admission year 2010	p
Age, mean years (SD)					
male	61,7 (12,5)	59,8 (12,3)		60,6 (11,8)	0,23
female	67,2 (12,3)	65,8 (13,2)		69,2 (12,8)	0,04
Diabetes mellitus (%)	16,1	16,7		16,8	0,47
Hypertension (%)	53,0	48,2		55,9	<0,001
Dyslipidemia (%)	54,0	57,9		48,1	<0,001
Current smoker (%)	46,8	46,5		43,5	0,04
Obesity (BMI>30 kgm^2) (%)	19,6	15,1		22,9	0,05
Charlson Index ≥2 (%)	14,5	23,5		16,6	0,03

Tab.: Baseline characteristics of STEMI patients who underwent PCI 2000–2010 (n=10,408) STEMI: ST-segment elevation myocardial infarction; PCI: percutaneous coronary intervention

Female STEMI patients arrived at hospital later with a pre-hospital delay 18% longer than male patients, after adjusting for age this reduced slightly to 11%. To put this in mathematical terms the delay for women was the same as the delay for men plus an additional 15 years. Door-to-balloon time decreased from 60 minutes (IQR 30, 155 min) in 2000 to 53 minutes (IQR 20, 90 min) in 2010 (Fig. 1). Although this translated into a very modest decrease in door-to-balloon time for male patients, the decrease for female patients was remarkable reducing from 80 minutes (IQR 26, 237 min) to 65 minutes (IQR 23, 99 min).

Guideline conformance results

The guideline conformance results of door-to-balloon time showed that in 2000, 65,9% and in 2010, 75,4% of all STEMI patients had PCI within 90 minutes. This also includes those who were transferred for intervention.

STEMI patients, who were transferred for intervention, had longer pre-hospital delays. In 2010 they were admitted 209 minutes (IQR 153, 428 min) after symptoms onset versus patients who were admitted in hospitals with catheter laboratory facilities 147 minutes (IQR 82, 360 min) after symptom onset. Last year door-to-balloon time was shorter in transferred patients, amounting only to 20 minutes (IQR 12, 33 min) versus 68 minutes (IQR 39, 105 min) in

Delays in STEMI patients

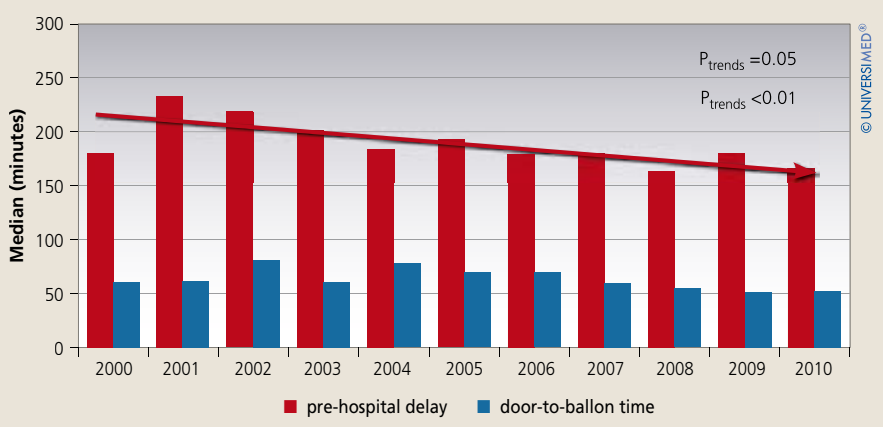

Fig. 1: Door-to-balloon time decreased from 60 minutes (IQR 30, 155 min) in 2000 to 53 minutes (IQR 20, 90 min) in 2010

Time to treatment

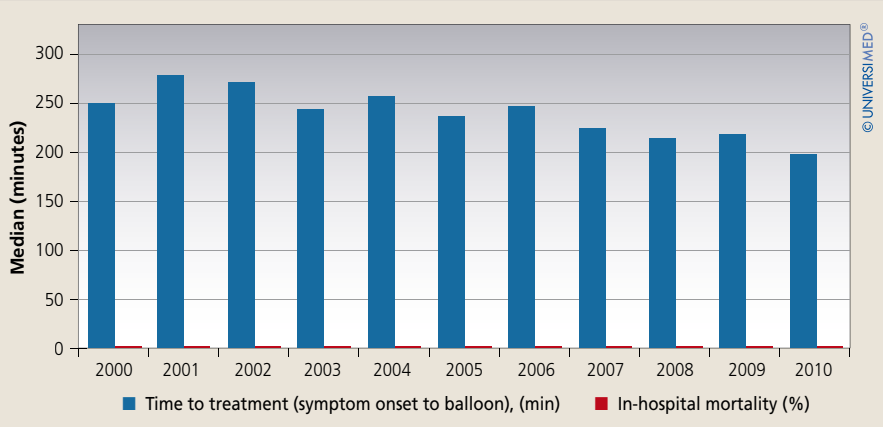

Fig. 2: Time to treatment of STEMI patients who underwent PCI, and in-hospital mortality

non-transferred patients. If a STEMI patient needs to be transferred for PCI he or she will be treated 14 minutes later. A total reduction of 17 minutes over an 11-year period in the overall time to treatment in Switzerland may not seem very impressive but when data were stratified into the period before 2005 and the period after 2005 delay decreased by 34 minutes. Comparing delay data from 2000 to 2002 with data from 2008 to 2010 showed a decrease in time to treatment of 53 minutes! This means that STEMI patients are now undergoing PCI almost 1 hour earlier than at the beginning of the decade.

Although overall time to treatment of STEMI patients in Switzerland during the last 11 years decreased >10%, it did not translate into a significant reduction of in-hospital mortality in this patient population (Fig. 2).

Elapsed time from symptom onset to hospitalization is a well-known problem worldwide[5] and numerous trials have been performed aiming to reduce pre-hospital time. Attempts have been made to reduce pre-hospital time through public campaigns. The HELP campaign from the Swiss Heart Foundation was launched in 2007 and in 2008 shorter pre-hospital delay could be observed, mostly in males, STEMI patients and patients below 75 years of age.[4] However, general physicians, who are often the first point of call for patients with chest pain or shortness of breath within 6 hours, might play the most important role in decreasing pre-hospital time.

As the effectiveness of PCI is highly dependent on its timeliness, projects have been conducted using pre-hospital diagnostic procedures and direct referral for PCI[5–7] in various countries including Holland[8], Denmark[9] and Geneva[10]. Consequently, door-to-balloon times were considerably shortened.[7, 11]

Currently the preferred pathway recommended is immediate transportation of STEMI patients to a PCI-capable center offering an uninterrupted primary PCI service by a team of high-volume operators.[12] Some hospitals in Switzerland are already using ECG recordings from ambulances and patients are then transported directly to the PCI centers. The impact of this procedure still needs to be evaluated in terms of overall outcome. This is a very promising approach and should possibly be routine practice in the real-world situation.

Conclusions

Pre-hospital delay of STEMI patients is still too long but door-to-balloon time is well within the guideline-recommended timeframe in Switzerland. However, although time to treatment of STEMI patients decreased during the last 11 years, it did not translate into a significant reduction of in-hospital mortality in this patient population.

Efforts to improve outcome should not simply address a single quality measurement but instead embrace the broader spectrum of procedures in acute myocardial infarction care.

References:

[1] *Antman EM et al: 2007 Focused Update of the ACC/AHA 2004 Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines: developed in collaboration with the Canadian Cardiovascular Society endorsed by the American Academy of Family Physicians: 2007 Writing Group to Review New Evidence and Update the ACC/AHA 2004 Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction, Writing on Behalf of the 2004 Writing Committee. Circulation 2008; 117(2): 296-329*

[2] *Van de Werf F et al: Management of acute myocardial infarction in patients presenting with persistent ST-segment elevation: the Task Force on the management of ST-segment elevation acute myocardial infarction of the European Society of Cardiology. Eur Heart J 2008; 29(23): 2909-45*

[3] *Radovanovic D et al: Swiss registry of acute coronary syndrome. Heart 2010; 96(12): 917-21*

[4] *Naegeli B et al: Impact of a nationwide public campaign on delays and outcome in Swiss patients with acute coronary syndrome. Eur J Cardiovasc Prev Rehabil 2011; 18(2): 297-304*

[5] Terkelsen CJ et al: System delay and mortality among patients with STEMI treated with primary percutaneous coronary intervention. JAMA 2010; 304(7): 763-71

[6] Studnek JR et al: Association between prehospital time intervals and ST-elevation myocardial infarction system performance. Circulation 2010; 122: 1464-9

[7] Sorensen JT et al: Urban and rural implementation of pre-hospital diagnosis and direct referral for primary percutaneous coronary intervention in patients with acute ST-elevation myocardial infarction. Eur Heart J 2011; 32(4): 430-6

[8] Atary JZ et al: Standardised pre-hospital care of acute myocardial infarction patients: MISSION! guidelines applied in practice. Neth Heart J 2010; 18(9): 408-15

[9] Pedersen SH et al: Field Triage Reduces Treatment Delay and Improves Long-Term Clinical Outcome in Patients With Acute ST-Segment Elevation Myocardial Infarction Treated With Primary Percutaneous Coronary Intervention. J Am Coll Cardiol 2009; 54(24): 2296-302

[10] Grosgurin O et al: Prehospital emergency physician activation of interventional cardiology team reduces door-to-balloon time in ST-elevation myocardial infarction. Swiss Med Wkly 2010; 140(15-16): 228-32

[11] Krumholz HM et al: Improvements in door-to-balloon time in the United States, 2005 to 2010. Circulation 2011; 124(9): 1038-45

[12] Wijns W et al: Guidelines on myocardial revascularization: The Task Force on myocardial revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS). Eur Heart J 2010; 31(20): 2501-55

Authors:
Dragana Radovanovic
Philip Urban, Giovanni Pedrazzini
Hans Rickli, Paul Erne

Corresponding author:
Dragana Radovanovic, MD
Head of AMIS Plus Data Center
Institute of Social and Preventive Medicine
University of Zurich
Hirschengraben 84, 8001 Zurich
www.amis-plus.ch
E-Mail: dragana.radovanovic@uzh.ch
LOkar110400